Minutes of Working Group 16 of the OCS Subcommittee of the IEEE Rail Transit Vehicle Interface Standards Committee

Date: January 27-28, 2005
Location: METRO Rail Operations Center
1601 West Bellfort
Houston, Texas

Minutes:

Working group members in attendance included Dick Egen, Alwyne Pugh, Jeffrey Sisson. John Estes, although not a member of the working group, participated. Ian Hayes was in attendance, but was involved with another working group.

Comments on the second draft of the IEEE Draft Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles, document P1629D2.1, were received from Mike Lewis at the meeting. There were 106 individual comments annotated on the document, covering everything from format and grammar to contact and technical matters. In addition, various comments by Alwyne Pugh were reviewed.

Most of the comments were addressed and were either closed or incorporated into the third draft of the standard. Some could not be addressed at the time and were left for further review by others in the working group.

Following the meeting, the 106 comments from Mike Lewis were put into written form, numbered and placed into a document for future reference and to document the effort.

Further comments were received from others subsequent to the meeting. Charlie Mullen submitted 40 additional comments, and 41 were received from Lou Tobio. Each of these comments have been reviewed by me and either incorporated into the standard, closed, or left for further discussion by the working group. These comments, except for those from Alwyne Pugh which were not recorded, are included in the attached document entitled **"**Comments on Draft Standard IEEE-P1629D2.1"

There are 17 comments that would require advice or further review by the committee. These are included in the attached document entitled "Open Items in Draft D3."

The third draft of the standard is expected to be released for review by the working group members and other interested parties.

Respectively submitted:

Jeffrey N. Sisson
Chair – Working Group 16
February 15, 2005

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
1	D2.1	M. Lewis	i	Cover	Copyright 2000 should be 2005	Yes. This is in the IEEE template. Will be changed to refer to year in which standard is accepted by IEEE, which may well be 2005.	Change incorporated in Draft D3
2	D2.1	M. Lewis	ii	Introduction	Remove 2nd and 3rd sentence of second paragraph as being not relevant to pantographs	Change incorporated in Draft D3	Change incorporated in Draft D3
3	D2.1	M. Lewis	ii	Introduction	In fifth paragraph, remove "implementations of" from fifth line.	Yes. This will be removed.	Change incorporated in Draft D3
4	D2.1	M. Lewis	ii	Introduction	In Note following fifth paragraph, place comma after "e.g.".	Not necessary	Closed
5	D2.1	M. Lewis	All pages	Footer	Change year from 2001 to 2004 or 2005 in footer and copyright statement	Yes. This is in the IEEE template. Will be changed to refer to year in which standard is accepted by IEEE, which may well be 2005.	Change incorporated in footer in Draft D3
6	D2.1	M. Lewis	4	1.1	Move first paragraph to after second paragraph	Not necessary. The first paragraph is a short statement as to what this standard is and should remain.	Closed
7	D2.1	M. Lewis	4	1.2	Second paragraph: change "where propulsion and auxiliary systems electrical power" to "where the electrical power for propulsion and auxiliary systems".	Comment accepted. Document to be changed as noted	Change incorporated in Section 1.2 of Draft D3
8	D2.1	M. Lewis	6	3.1.5, 3.1.6	We should use the APTA definitions for light rail transit and heavy rail transit.	Generally agree. But these two definitions are used in other IEEE publications prepared by the RTVSIC. See P1475 for example. Would prefer to use these rather than the APTA definitions. But will review	To be reviewed. Comment refers to Sections 3.1.10 and 3.1.12
9	D2.1	M. Lewis	6	3.1.9	In first line the words "also 'service proven' or 'proven'" should be "also proven". Service Proven is already in the title of the section	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.1.16 of Draft D3
10	D2.1	M. Lewis	6	3.1.9	Remove "that" in first ;line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.1.16 of Draft D3

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
11	D2.1	M. Lewis	6	3.1.10	The second paragraph currently reads: "In the up, or operating, position the pantograph is contacting the overhead contact wire and is entirely, or partially, under voltage. In the down, or stowed, position, the pantograph is locked down and not in contact with the overhead contact wire or any part of the overhead contact system." Recommend changing to read: "When the overhead contact system is energized, the pantograph, in the up, or operating, position is entirely, or partially, under voltage since it is contacting the overhead contact wire. In the down, or stowed, position, the pantograph is not energized since it is locked down and not in contact with the overhead contact wire or any part of the overhead contact system."	Leave wording as is., except add clarification by adding words "depending on state of energization of the overhead contact wire" to end of first sentence.	Change incorporated in Section 3.2.1 of Draft D3
12	D2.1	M. Lewis	7	3.1.13	Insert "frame" following "base" in second line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.4 of Draft D3
13	D2.1	M. Lewis	7	3.1.15	In first line, replace words "in a vertical or nearly vertical direction with respect" with "perpendicular".	Prefer to leave as is. The word vertical is more descriptive. Although such a case could not be imagined, there is nothing to preclude a pantograph assembly wit a slanted base frame to fit around something on the car roof. And the pantograph collector head must move up and down vertically Let committee review and consider a change to clarify vertical with car on level, tangent track.	To be review by committee. Comment applies to Section 3.2.6
14	D2.1	M. Lewis	7	3.1.15	Change "base plane" to "plane of the base frame" in second line.	Prefer to leave as is. Base plane is defined.	Closed
15	D2.1	M. Lewis	7	3.1.15	Change "in a horizontal or level position" with "essentially parallel to the plane of the base frame" in the second line.	Prefer to leave as is.	Closed

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
16	D2.1	M. Lewis	7	3.1.15	Insert “pantograph” before “frame” in third line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.6 of Draft D3
17	D2.1	M. Lewis	7	3.1.16	Replace “attached” with “that lie” in first line.	Prefer to leave as is.	Closed
18	D2.1	M. Lewis	7	3.1.16	Insert “pantograph” before “frame” in second line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.7 of Draft D3
19	D2.1	M. Lewis	7	3.1.16	Add “relatively” before “constant” in fourth line.	Prefer to leave as is. The tolerance on the force is specified later.	Closed
20	D2.1	M. Lewis	7	3.1.17	Replace “A part of the pantograph that is” to “That part of the pantograph which is” in first line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.8 of Draft D3
21	D2.1	M. Lewis	7	3.1.17	Replace “mechanically connected by a frame” with “mechanically inter-connected by the head frame” in third line.	Change not necessary. But will remove reference to a frame.	Changed incorporated in Section 3.2.8 of Draft D3
22	D2.1	M. Lewis	7	3.1.18	Change “A spring and damper assembly that supports” to “Spring and damper assemblies that support” in second line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.9 of Draft D3
23	D2.1	M. Lewis	7	3.1.18	Change “absorbs” to “absorb” in second line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.9 of Draft D3
24	D2.1	M. Lewis	7	3.1.18	Insert “pantograph” before “frame” in second line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.9 of Draft D3
25	D2.1	M. Lewis	7	3.1.19	Insert “assembly” after “head” in first line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.10 of Draft D3
26	D2.1	M. Lewis	7	3.1.20	Change “ensures a smooth engagement with any” to “ensure smooth engagement or dis-engagement between any” in first line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.11 of Draft D3

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
27	D2.1	M. Lewis	7	3.1.20	Replace “wire and with” with “wire, or with” in second line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.11 of Draft D3
28	D2.1	M. Lewis	8	3.1.21	Insert “at the outer end of the horn” after “hook” in first line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.2.12 of Draft D3
29	D2.1	M. Lewis	8	3.1.22	Change “The axis transverse to the centerline of the vehicle along which the collector head assembly rotates” to read “The pivot axis lies transverse to the centerline of the vehicle. The pivots permit the collector head assembly to rotate so that it can more easily accept transitions in the gradient of the contact wire”.	Agree. The standard will be changed per the comment, but different wording is to be used.	Change incorporated in Section 3.2.13 of Draft D3
30	D2.1	M. Lewis	8	3.1.23	Change “the pantograph that when manually activated will” to “the pantograph which, when manually activated, will” in first line.	Actually the section is to be entirely revised.	Change incorporated in Section 3.2.14 of Draft D3
31	D2.1	M. Lewis	8	3.1.23	Replace “of vehicle pneumatic and/or low voltage power not being available” with “of the normal vehicle pneumatic and/or low voltage power being not available” in third line.	Actually the section is to be entirely revised.	Change incorporated in Section 3.2.14 of Draft D3
32	D2.1	M. Lewis	8	3.1.24	Delete “can shunt and” in first line.	Agree. The standard will be changed per the comment, but different wording is to be used.	Change incorporated in Section 3.2.15 of Draft D3
33	D2.1	M. Lewis	8	3.1.26	In second paragraph, delete words “which drawing shall be submitted by the supplier to the customer for review and approval” as not relevant.	The requirement is relevant and necessary. No change to be made.	Closed
34	D2.1	M. Lewis	8	3.1.27	Insert “the” before “collector” in first line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.3.1 of Draft D3

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
35	D2.1	M. Lewis	8	3.1.27	Move words “and transversely in relation to the vehicle” from the end of the sentence to after word “measured”.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.3.1 of Draft D3
36	D2.1	M. Lewis	9	3.1.34	Replace “two lines radiating out through the points where the - - - 3.1.28, intersect” with “two planes intersect. These planes radiate out from the - - 3.1.28”.	The entire section is to be rewritten.	Change incorporated in Section 3.3.8 of Draft D3
37	D2.1	M. Lewis	9	Outlined note between Sections 3.1.34 and 3.1.35	Delete first and second paragraphs.	Agree. The standard will be changed per the comment. The boxed note will probably as an informative note.	Change incorporated in Section 4.5.3 of Draft D3
38	D2.1	M. Lewis	9	Outlined note between Sections 3.1.34 and 3.1.35	Replace “pivot angle & from” with “pivot angle and, from” in first line of fourth paragraph.	Agree. The standard will be changed per the comment. The boxed note will probably as an informative note.	Change incorporated in Section 4.5.3 of Draft D3
39	D2.1	M. Lewis	9	Outlined note between Sections 3.1.34 and 3.1.35	Insert “be” following “140^{o}” in second line of fourth paragraph.	Agree. The standard will be changed per the comment. The boxed note will probably as an informative note.	Change incorporated in Section 4.5.3 of Draft D3
40	D2.1	M. Lewis	9	Outlined note between Sections 3.1.34 and 3.1.35	Change “instability. This frictional” to “instability of the head assembly. This frictional” in third paragraph.	Agree. The standard will be changed per the comment. The boxed note will probably as an informative note.	Change incorporated in Section 4.5.3 of Draft D3
41	D2.1	M. Lewis	9	Outlined note between Sections 3.1.34 and 3.1.35	Replace word “suggested” with “recommended”. In second line of third paragraph.	Agree. The standard will be changed per the comment. The boxed note will probably as an informative note.	Change incorporated in Section 4.5.3 of Draft D3
42	D2.1	M. Lewis	9	3.1.35, 3.1.36, 3.1.37, 3.1.38 and 3.1.39	Change “vertical” to “perpendicular” in first line of all five sections.	Vertical is the preferred and more descriptive term.	Closed
43	D2.1	M. Lewis	9	3.1.36, 3.1.37 and 3.1.39	Change “pantograph being raised” to “pantograph raised” in second line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.3.9 to 3.3.13 of Draft D3

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
44	D2.1	M. Lewis	9	3.1.38	Change “dynamic range over which the pantograph will normally operate” to “dynamic range through which the pantograph will operate normally”.	No change	Closed
45	D2.1	M. Lewis	9	3.1.39	Delete “being” before “raised” in second line.	Agree. The standard will be changed per the comment. Actually the phrase “the pantograph being raised to the lowest level at which it is designed to collect current” will be changed to read “the pantograph in the locked-down and stowed position”.	Change incorporated in Section 3.2.13 of Draft D3
46	D2.1	M. Lewis	10	3.1.40 and 3.1.41	Change “center” to “centerlines” in first line.	Change not necessary. The word “centers” is more descriptive.	Closed
47	D2.1	M. Lewis	10	3.1.43	Change section title from “Frame Width (FW)” to “Base Frame Width (FW)”	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.3.17 of Draft D3
48	D2.1	M. Lewis	10	3.1.45	Use lower case for manual emergency release	Agree. The standard will be changed per the comment.	Change incorporated in Section 3.3.19 of Draft D3
49	D2.1	M. Lewis	11	3.1.48 to 3.1.50	Should be 3.1.51 to 3.1.53	Yes. All paragraph numbering to be verified.	Change incorporated in Draft D3
50	D2.1	M. Lewis	11	3.1.50	Change “vertical” to “upward” in first line.	Vertical is more descriptive. No change necessary.	Closed
51	D2.1	M. Lewis	12	4.1	Delete “with reference to their definition” and “as” in first line.	Actually, the words will be replaced by “as defined in Section 3.	Change incorporated in Section 4.3 of Draft D3
52	D2.1	M. Lewis	12	4.1	Change “insulators” to “insulator” in second bullet.	Agree. The standard will be changed per the comment.	Change incorporated in Section 4.3 of Draft D3
53	D2.1	M. Lewis	12	4.2	Add “it is recommended that” following “authority” in first line.	As this is a standard and not a recommended practice, it is more appropriate to directly state requirements as such. The intent is that unless otherwise specified, a standard head length will be used.	Closed

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
54	D2.1	M. Lewis	12	4.2	Remove word “shall” and change “1982 mm” to “1980 mm”	Rather keep the absolute metric equivalent of 78”	Closed
55	D2.1	M. Lewis	12	4.3	Comment on third paragraph and boxed note following: Quantifying this requirement is virtually impossible. There are simply too many variables that are beyond the control of the pantograph manufacturers.	No change needed. Wording is sufficient as-is.	Closed
56	D2.1	M. Lewis	12	4.5	Change “positions” to “requirements” in first line.	The word “positions” is more appropriate and descriptive. The pantograph industry uses positions.	Closed
57	D2.1	M. Lewis	13	4.6	Add “frame” to “collector head” in third line of first paragraph.	Rather than use word “frame”, the word “assembly” will be inserted.	Change incorporated in Section 4.5.5 of Draft D3
58	D2.1	M. Lewis	13	4.6	Insert word “Alternately” before “the end horn hook” in second line of second paragraph.	Agree. The standard will be changed per the comment.	Change incorporated in Section 4.5.5 of Draft D3
59	D2.1	M. Lewis	13	4.8	Change “Maximum rate of rise and fall of the overhead contact wire” to “Maximum rate of rise or fall (gradient) of the overhead contact wire relative to track”.	Actually, “rate of rise and fall” will be replaced by gradient. Also, the phrase “in relation to vehicle speed” will be added to the end of the sentence.	Change incorporated in Section 4.2 of Draft D3
60	D2.1	M. Lewis	13	4.8	Add bullet “Maximum change in gradient of the contact wire at a support point”.	Agree. The standard will be changed per the comment.	Change incorporated in Section 4.2 of Draft D3
61	D2.1	M. Lewis	13	4.8	Delete “Maximum vehicle overspeed”.	Disagree. There may be cases where the maximum vehicle overspeed needs to be considered, particularly where it is much higher than the specified operating speeds.	Closed
62	D2.1	M. Lewis	14	4.9	Remove space following “authority and before the comma in first lines of first and second paragraphs.	Agree. The standard will be changed per the comment.	Change incorporated in Section 4.6.2 of Draft D3
63	D2.1	M. Lewis	14	4.10	Section 3.1.50 should be 3.1.53.	Paragraph numbering to be verified.	Change incorporated in Section 4.6.3 of Draft D3

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
64	D2.1	M. Lewis	14	4.11	Is there a conflict between the words "with the pantograph at the Maximum Working Height (HMAX)" and the heights shown in the table?	Yes there is a conflict. The words "at the Maximum Working Height (HMAX)" is to be changed to read "at the heights given in the table below"	Change incorporated in Draft D3
65	D2.1	M. Lewis	15	4.12	Delete phrase "does not specify a single piece, bonded, curved design and, rather" in first line of fourth paragraph.	Agree. The standard will be changed per the comment.	Change incorporated in Section 4.5.4 of Draft D3
66	D2.1	M. Lewis	15	4.12	Delete "each side of" in third line of fourth paragraph.	The words "each side of" are more descriptive and will remain. In Ian Hayes' dictionary of terms, stagger is defined as the deviation from track centerline, so including the words "each side" would be technically correct and specific.	Closed
67	D2.1	M. Lewis	15	4.13	Comment on second paragraph: How can this be achieved?	To be more descriptive and to remove any misinterpretation, the words "any break in" in the first line will be replaced by "any loss of contact with"	Change incorporated in Section 4.7.1 of Draft D3
68	D2.1	M. Lewis	15	4.13	In second paragraph, change "case of vehicle pneumatic and/or low voltage power not being available" to "case that the vehicle pneumatic and/or low voltage power is not available".	The entire section has been revised to clarify the requirements, beyond the comment.	Change incorporated in Section 4.7.2 of Draft D3
69	D2.1	M. Lewis	15	4.13	Delete fourth paragraph.	Agree. The standard will be changed per the comment.	Change incorporated in Section 4.7.1 of Draft D3
70	D2.1	M. Lewis	15	4.15	Delete "approved" in first line.	The word "approved" needs to remain. The operating authority should receive a pantograph with a service proven automatic drop down (ADD) system or, at the very least, have the power of approval for such a system. However requiring a "service proven" system may preclude a new concept ADD system that has not yet met the service proven requirements. The term "approval" does need definition.	Closed

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
71	D2.1	M. Lewis	15	4.15	Delete extra space following “mechanically” and comma following “activated”.	Agree. The standard will be changed per the comment.	Change incorporated in Section 4.7.3 of Draft D3
72	D2.1	M. Lewis	16	4.15	Change “lock-down height, or below, following” to “lock-down height, following”	Agree. The standard will be changed per the comment.	Change incorporated in Section 4.7.3 of Draft D3
73	D2.1	M. Lewis	16	4.16	Regarding word “additional” in first line of second paragraph, additional to what?	Intent is for pantograph supplier to define and promulgate those vertical and horizontal forces encountered under conditions stated, in addition to the static weight. This information would be necessary to ensure that the mechanical support of the pantograph assembly is proper. However, the sentence will be revised to read: “Any vertical and horizontal forces, in addition to the weight of the pantograph, that would be imparted by the operation of the operating system and automatic drop down system, if supplied, shall be specified by the pantograph supplier.:	Change incorporated in Section 4.8.2 of Draft D3
74	D2.1	M. Lewis	16	4.16	Delete words “vertical and horizontal”	Leave as is. See response to comment 73	Closed
75	D2.1	M. Lewis	16	4.18	Change “suppliers name and address” to “name and address of supplier”.	Agree. The standard will be changed per the comment.	Change incorporated in Section 4.8.4 of Draft D3
76	D2.1	M. Lewis	17	5	Change words “sections 5.1 to 5.4. Annex B groups by category the individual” to “sections 5.1 to 5.4 and listed in Annex B by category. The individual ” in first line of third paragraph.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5 of Draft D3
77	D2.1	M. Lewis	17	5.1	Add words “often termed Type Tests” to title.	Change to be made, but to first paragraph rather than title.	Change incorporated in Section 5.1 of Draft D3

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78	D2.1	M. Lewis	17	5.2	Add words “often termed Production Tests” to title.	Title to be changed from “Routine Tests” to “Acceptance Tests” to reflect vehicle specifications terminology. Words “also known as routine or production tests” to be added to first paragraph.	Change incorporated in Section 5.2 of Draft D3
79	D2.1	M. Lewis	17	5.2	Change word “type” to “qualification” in second line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.2 of Draft D3
80	D2.1	M. Lewis	17	5.2	Change “tests achieved on a number of” to “tests performed on a selected number of”	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.2 of Draft D3
81	D2.1	M. Lewis	17	5.4	Insert word “are” following “which” in first line of first paragraph.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.4 of Draft D3
82	D2.1	M. Lewis	17	5.4	Change “customer” to “customer’s” in first line of second paragraph.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.4 of Draft D3
83	D2.1	M. Lewis	18	5.8	Comment: Where is Section C?	Section C is from a prior format which was deleted. Entire sentence that contains Section C to be deleted.	Change incorporated in Section 5.8.1 of Draft D3
84	D2.1	M. Lewis	18	5.8, 5.9 and 5.11	Section 4.16 should be 4.18, 4.14 should be 4.16 and 4.13 should be 4.15.	Agree. The standard will be changed per the comment.. Paragraph numbering needs to be checked throughout the document.	Change incorporated in Draft D3
85	D2.1	M. Lewis	19	5.12	In second paragraph, change “impact and rebound that is injurious” to “impact or significant rebound that would be injurious”.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.8.5 of Draft D3

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86	D2.1	M. Lewis	19	5.12	Comment on third paragraph where 10 seconds raising time is stated: If the raising speed is 2 inches/second (para 5.15) 10 seconds = 20 inches only. Revise!	No change is necessary as there is no issue here. Thee reference to para 5.15 should be 5.23, and that refers to 2 inch/sec as the speed at which the force measurements are to be taken. A published raising speed. A recent data sheet for a Stemmann Fb700 pantograph states a raising speed of 5 seconds for a 2,670 mm (105 inches), which is a raising speed of 21 inches per second. That is 10 times the 2 inches/second figure.	Closed.
87	D2.1	M. Lewis	19	5.13	Climactic should be climatic in title.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.8.6 of Draft D3
88	D2.1	M. Lewis	19	5.13	In second paragraph, “customer” should be “customer’s” in third line.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.8.6 of Draft D3
89	D2.1	M. Lewis	19	5.13	In third paragraph, change “impact and rebound that is injurious” to “impact or significant rebound that would be injurious”.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.8.6 of Draft D3
90	D2.1	M. Lewis	19	5.13	The entire test seems repetitive. Needs quantification.	It is difficult to quantify the qualitative requirement of “in a smooth and steady manner, without undue shock”. The test is not repetitive. The test of Section 5.12 is conducted at ambient. The test of this section is conducted at the temperature extremes.	Closed
91	D2.1	M. Lewis	19	5.14	Typos: delete comma following “operations” and “(HL) in first paragraph. Correct word “Exte3nded” to “Extended”.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.8.7 of Draft D3
92	D2.1	M. Lewis	20	5.15	Insert word “directions” following “transverse” in first line of the first paragraph.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.8.8 of Draft D3

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
93	D2.1	M. Lewis	20	5.15	Change “1 Hz“1 Hz to 50 Hz for at least four (4) minutes” to 50 Hz in 1 Hz increments and shall be sustained for at least four (4) minutes at each frequency”.	This is a resonant search test, which is normally conducted with a frequency sweep over 4 minutes so that frequencies at other than whole frequencies can be tested. These type tests are not conducted by stepping the frequency in 1 Hz increments and maintaining the frequency for a 4 minute interval. I used to conduct resonant search tests many years ago at GE.	Closed
94	D2.1	M. Lewis	20	5.15	Change “The test is carried out” to “The test shall be carried out.	Agree. The standard will be changed per the comment.	Change incorporated in Section 5.8.8 of Draft D3
95	D2.1	M. Lewis	20	5.17	Change 3g’s to 3g in two places.	The term 3g’s is correct.	Closed
96	D2.1	M. Lewis	21	5.19	With reference to the words “air bellows” and “cylinder piston and packing”, these items have not been discussed or specified in this document.	Agreed. These words were deleted and the sentence changed to read: “If pneumatic, the operating system shall be tested to ensure that all components are sealed against leakage”.	Change incorporated in Section 5.8.12 of Draft D3
97	D2.1	M. Lewis	21	5.20	Type. Word “climactic” should be “climatic” in title.	Agreed	Change incorporated in Section 5.8.13 of Draft D3
98	D2.1	M. Lewis	21	5.20 and 5.21	Question about requirements being repetitive.	The tests are not repetitive. The test of Section 5.19 is a straightforward test for air leakage. The test of Section 5.20 is a similar test conducted at extreme temperatures.	Closed
99	D2.1	M. Lewis	21	5.22	Shouldn’t this [retaining force in lock down position] have been specified in Section 4? Same as second paragraph on next page.	Yes. It is defined in the second paragraph of this section, and will be moved to Section 4 where it belongs.	Change incorporated in Section 5.8.15 of Draft D3

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
100	D2.1	M. Lewis	22	5.23	The third paragraph should be in Section 4.	The numbers in the paragraph are not raising or lowering time requirements. Rather, they are force measuring requirements. The static contact force is usually measured with the pantograph stationary, but in this standard the measurement is to be taken with the pantograph slowly raising and lowering.	Closed
101	D2.1	M. Lewis	22	5.23 and 5.24	In last paragraph of each section, reference to Section 4.7 should be 4.9 and that to 4.9 should be 4.10	Agree. The standard will be changed per the comment. Paragraph numbering needs to be checked throughout the document.	Change incorporated in Draft D3
102	D2.1	M. Lewis	23	5.26	In second paragraph, regarding the words “immediately following”, how long after since this requires a special test set-up?	No change required. This test would be conducted on a vehicle, most likely a work car, with a dummy load, such as resistors, that would be switched in any out with contactors as needed. Therefore there should be no need to reconfigure the test set-up. However, a clarification in wording will be looked at.	Review
103	D2.1	M. Lewis	23	5.29	With reference to the words “direct-current power”, does this also apply for AC systems?	This is not applicable as this standard is for light rail and heavy rail (i.e. “Metro”) systems, and these only use DC power. We do not know of any AC systems in this category.	Closed
104	D2.1	M. Lewis	24	5.29	Surely this is the same test as 5.25?	Section 5.25 specifies a test at rated currents with the pantograph at standstill. That test is conducted with rated standstill current for 30 minutes followed by peak standstill current for 30 seconds. Section 5.29 specifies more of an endurance type of test, conducted with rated standstill current at 60 minutes followed by the peak standstill current for 150 seconds. After further review following the Houston meeting, the requirements of the two tests have been merged into one. See Section 5.8.18).	Change incorporated in Section 5.8.18 of Draft D3

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
105	D2.1	M. Lewis	25	Annex A Figure 1	In side view, refer to item 10 in view at working height rather than at extended height. In end view, refer to Item 10 at each end at Item 6.	Agree. The standard will be changed per the comment.	Change incorporated in Figure A.1 of Draft D3
106	D2.1	M. Lewis	26	Annex B Test Requirements	Not reviewed	None	No change per comments
107	D2.1	C. Mullen	25	Annex A Figure 1:	The drawing appears to be a Transtech or Stemmann design single arm pantograph. This is an older design pantograph that does not represent what is typical today. There are features depicted in this drawing that are not standard or typical. Perhaps a more generic drawing can be used that depicts only the main components for pantographs, Base frame, Upper frame, Lower frame, Coupling Rod, Collector Head and Pan-guide.	The drawing is not intended to represent what is typical today. The drawing was intended to be generic and neutral. I do not have any further time to spend on this, but if someone has any ideas for improving the drawing, please sketch the changes and send them to me. Better still, maybe someone can draw it and create a TIF image file for inclusion in the standard. Please define coupling rod and pan guide in the context of the current drawing.	To be considered by the committee as review of version D3 Looking for someone to re-do figure Comment applies to Figure A.1in Annex A
108	D2.1	C. Mullen	N/A	General	Why is the specification not applying to EMU's. Pantographs utilized for Light Rail Vehicles in North America can also be used for Electric Multiple Units. The Los Angeles P2550 Light Rail Vehicle Pantographs are also supplying to NICTD, METRA and are specified for SEPTA V Cars. There are no differences in equipment.	Per the approved IEEE PAR, the standard is limited to transit use (light rail and heavy rail vehicles). Standards that apply to railroad cars are beyond the scope of this standard.	Closed
109	D2.1	C. Mullen	6	3.1.10	The words "one or more contact wires" is included twice in the sentence.	This does not occur in the in second draft I have. It was repeated at one time, but was removed in version D1. If the Word version was being reviewed, and if the changes were rejected in the "Track Changes" facility, then the repeat words would appear.	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
110	D2.1	C. Mullen	7	3.1.11	The features Primary Suspension, Breakaway Mechanism, Automatic Drop Down Mechanism should not be considered part of a typical pantograph. These features are normally options (cost drivers) that can be incorporated into some designs. It is not possible in all cases to provide these features.	This section is devoted to definitions, and even if something is an option, it still needs to be defined. Things like breakaway mechanism and ADD are at the option of the customer. If there are comments on specific matters, then they should be separately addressed.	Closed
111	D2.1	C. Mullen	7	3.1.15	The EN 50206 Standard description for Frame Assembly as follows: “An articulated structure which enables the collector head to move in a vertical direction with respect to the base frame of the pantograph”. The components included can vary from each manufacturer. Terminology may also differ. The components in the draft spec. & drawing are only accurate for Transtech or Stemmann design.	The standard states that there are variations on the design and that a pantograph frame would generally include those items. If there is any alternate terminology, then that needs to be defined and included in the standard. The definition of “pantograph” has been changed slightly in version D3. The drawing is meant to be a typical pantograph. See comment 107 above.	Closed pending further comment from committee. Comment applies to Section 3.2.6
112	D2.1	C. Mullen	7	3.1.16	I am not familiar with a system as described. The description sounds like it is incorporating four systems, Pan Head Suspension, Oscillation Dampers, Raising Mechanism and Lowering device.	T the primary suspension functions to cushion the dynamic motion of the pantograph. The description says “the primary suspension is usually spring, pneumatically or electrically actuated and --”.	Closed pending further comment from committee. Comment applies to Section 3.2.7
113	D2.1	C. Mullen	7	3.1.17	The pan-head description including item (6) is only accurate for Transtech or Stemmann designs. The EN 50206-2 Standard description for Collector Head is as follows: Part of the pantograph supported by the frame assembly which includes contact strips, horns and may include a suspension.	To be revised to make secondary suspension (also called pan head suspension) optional, but is to be provided unless the customer states otherwise. See comment 114 below.	Change incorporated in Section 3.2.8 of Draft D3

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
114	D2.1	C. Mullen	7	3.1.18	This description is only accurate for Transtech and Stemmann designs. Pan-head suspension can not prevent shock loads from being transmitted to the frame assembly. Pan-head suspension absorbs small oscillations that can occur in service. The suspension improves tracking capability.	See also comment 113. Also revised Section 2.2.9 in version D3 to clarify function of secondary suspension. Also added a definition of pantograph tracking as Section 3.4.12 to version D3. Please review these changes.	Change incorporated in Section 3.2.9 of Draft D3
115	D2.1	C. Mullen	7	3.1.20	End horn hooks are not typical. I am only aware of one property that utilizes and end horn hook. The hook can not prevent the OCS from moving under the pan-head under all circumstances. Proper maintenance of the complete system is the only prevention.	Section 3.1.20 is only the definition of an end horn hook at this point in the standard. Section 4.6 includes the actual requirement that end horn hooks be provided, unless the operating authority specifies otherwise. The MBTA swears by end horn hooks. They are used on MBTA Green Line and Blue Line vehicles, and that will not change. SFMR also used them for a while on the Boeing SLRV's. These have saved the MBTA overhead on numerous occasions. See note from Paul White dated 01-19-05.	No change to intent of Section 3.1.20 (now 3.2.11). Some minor wording changer made by committee in Houston. Closed
116	D2.1	C. Mullen	7	3.1.23	This description is accurate for the pantograph shown in the drawing. Manuals release arms are not typical. Release arms are only sometimes utilized with pantographs that are spring raised and pneumatically lowered. Most light rail applications today are utilizing spring raised pantographs which are electrically lowered or pneumatically raised pantographs which are gravity lowered. Manual release arms can not be incorporated into such a design. Where electrical lowering devices are utilized manual raising and lowering is accomplished with a flexible drive connection to the lowering device.	This section, now numbered 3.2.14, had already been reworded as follows: "A general term to describe secondary mechanical devices which enable raising or lowering the pantograph when the primary operating system as defined in Section 3.1.25 is not available.	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
117	D2.1	C. Mullen	7	3.1.22	Collector head pitch or degrees of freedom of the pan-head are usually agreed between the manufacturer and user. The pan degrees of freedom must be sufficient to track the OCS gradient. Reduced speeds are typical where severe grades occur. Typically a maximum 10-15 degrees of freedom are required.	This section is only a definition of the pivot and was not intended to require any rotational angle. That is covered later in Section 4.5.8 of draft D3.	Closed
118	D2.1	C. Mullen	12	4.4	Eliminate the 140 degree requirement.	The committee feels that this requirement is necessary for head stability as stated in renumbered Section 4.5.3. The requirement is to remain.	Closed
119	D2.1	C. Mullen	12	4.4	Wider pan-heads are utilized for high speed service where the aero dynamic influence affects the stability of the pan-head. Air foils may also be utilized to stabilize the pan-head and equalize upward force of collectors. Such a collector head is not required for typical speeds in light rail or heavy rail service.	Agreed. Nor is such a collector head with air foils even specified. However, this standard is devoted to light rail and heavy rail “metro” systems that tend to operate at lower speeds than suburban or intercity railroads. Nothing in the standard precludes a wider head, that is the option of the operating authority, but the 140-degree shall remain.	Closed
120	D2.1	C. Mullen	7	3.1.22	The EN 50206 Specification defines Collector Head Pivot as follows: “It is the pitching axis of the collector head”.	This definition has been reworded in Section 3.2.13 of version D3 as follows: “That pivot, with axis transverse to the centerline of the vehicle, which enables slight rotational, or pitching, motion of the collector head assembly, allowing the collector head assembly to adapt to transitions in the gradient of the overhead contact wire.”	Change incorporated in Section 3.2.13 of Draft D3
121	D2.1	C. Mullen	8	3.1.27	Eliminate end horn hooks.	See item 115 above	Closed
122	D2.1	C. Mullen	8	3.1.28	A typical North American Collector Head length is 78” inch +- .25”	Yes. This is the standard length required in Section 4.2, unless other specified by the authority. No tolerance has been included in the standard.	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
123	D2.1	C. Mullen	8	3.1.28	Typical pan-head width is measured center to center line of collector strips. A Typical North American Collector head width is 13.58" +-.20"	Figure 1 of Annex A shows SC as the longitudinal distance between contact strips and is measured between centers of the contact strips. The pan head width is WH is measured over the outside surface of the contact strips, and that is in accordance with both European standards BS-EN-50206-2 and IEC-494. Section 4.5.2 of the third draft standardized the distance between contact strips as 300 mm (11.81"). With 60 mm wide contact strips, the overall pan head width WH is 360 mm (14.17")	Closed
124	D2.1	C. Mullen	9	3.1.32	Carbon collector width can vary dependent on vehicle current rating. The typical and widest carbon collector width today is 60mm.	That is correct, and 60 mm is specified in Section 3.3.6 as the standard contact strip width, unless otherwise specified buy the customer.	Closed
125	D2.1	C. Mullen	8	3.1.29	I have seen a range of heights from 228 – 310mm.	Yes. Section 3.3.3 of the third draft has standardize on 310 mm.	Closed
126	D2.1	C. Mullen	8	3.1.30	Carbon Collector lengths vary dramatically in the US. The most common lengths are 54" & 42" inch. Some properties are using 1000mm length typical in Europe. The length in each case is really driven by the vehicle specification. As you know many times specifications are copy and paste.	Per the advice of Ian Hayes, the contact strip length has been standardized to 1320 mm (52") unless otherwise specified.	Closed
127	D2.1	C. Mullen	8	3.1.31	It will be difficult to specify the exact radius for carbon collectors. I would eliminate this section.	The third draft standardizes on a 6 meter radius for the contact strips, unless otherwise specified.	Closed
128	D2.1	C. Mullen	9	3.1.32	The maximum available width for carbon collectors is 60mm. This is most common today due to high current ratings of Light and Heavy Rail Vehicles.	Same as comment 124	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
129	D2.1	C. Mullen	9	3.1.33	generally stand still current is not a problem of the carbon strips - but of the catenary. It is important to know the section and no. of the wires. The supplier of the catenary proivides a max. temperature. This is a very important value for the stand still current. Has less to do with the pantograph.	Comment does not apply to Section 3.1.33. Standstill current could be an issue if the current results in the contact strip being heated to a temperature where the solder joint can degredate.	Closed
130	D2.1	C. Mullen	9	3.1.34	same comments as above.	Comment does not apply to Section 3.1.34.	Closed
131	D2.1	C. Mullen	9	3.1.37	The force should be in accordance with the catenary. The normal static force of light rail pantographs is all round 80N – 93N but could also be 120 N. This must be checked with the catenary system.	Comment does not apply to Section 3.1.67. Nominal static force is 80 Newtons but is to be adjustable to between 62 and 125 Newtons.	Closed
132	D2.1	C. Mullen	10	3.1.42	I would eliminate this section. There are many variations of insulators at different heights that could meet the insulation requirements for a specific application. The air gap insulation from lowest point of the pantograph to the vehicle roof is critical, Ref.Standard DIN-EN 50124-1.	Standard EN-20124-1 applies to main line railroads and is outside the scope of this standard. Section 4.8.5 of the third draft standardizes on these insulator heights, Any comments would be welcome.	Closed
133	D2.1	C. Mullen	10	3.1.43	I would eliminate this section. Insulator spacing is sufficient.	Believe that this section is necessary in the event that there are confining car structure elements on the roof in the pantograph area.	Closed
134	D2.1	C. Mullen	10	3.1.45	I would eliminate this section. Manual release arms are not typical for all pantographs.	Section number reference does not match comment. Section 4.7.2 has been added and changed to incorporate a more general emergency release and lowering system. See Sections 3.2.14 and 4.7.2 of the third draft.	Closed
135	D2.1	C. Mullen	10	3.1.48	The EN 50206 Specification defines Maximum Current as follows: The maximum value of the current withstood by the pantograph at standstill for a time given in the customer specification. I would eliminate times included in the draft specification?	Most operating authorities may not know how to define this parameter.. The 2-1/2 minutes is from the definition of traction motor short time overload current. See Section 3.4.4. Other definitions can be considered.	Closed

<table>
<tr><th colspan="8">Comments on Draft Standard IEEE-P1629D2.1
Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles</th></tr>
<tr><th>Comment Number</th><th>Standard Version No.</th><th>Comment From</th><th>Page Number</th><th>Section Number</th><th>Comment</th><th>Response</th><th>Status</th></tr>
<tr><td>136</td><td>D2.1</td><td>C. Mullen</td><td>11</td><td>3.1.48
(3.1.51)</td><td>I would eliminate the words “and the primary suspension”. Extension type springs or pneumatic air bag, raise the pantograph.</td><td>Section should have been numbered 3.1.51.

Primary suspension has been defined. See comment 112 above.</td><td>Closed pending further comment

Comment applies to Section 3.4.7</td></tr>
<tr><td>137</td><td>D2.1</td><td>C. Mullen</td><td>11</td><td>3.1.49
(3.1.52)</td><td>I would add the words “through the working range” and eliminate the words “at a minimum of four (4) different positions”.</td><td>Section should have been numbered 3.1.52.

This is a definition of how the static force is to be measured.</td><td>Closed pending further comment

Comment applies to Section 3.4.8</td></tr>
<tr><td>138</td><td>D2.1</td><td>C. Mullen</td><td>?</td><td>4.5.7 - 4.911</td><td>The EN 50206 Specification defines Transverse Rigidity as follows: The pantograph shall be extended to upper operating condition

When a force of 300 N is applied successfully on each side of the part of the frame which supports the collector head the displacement shall be in accordance with the following table:

<table><tr><td>Extension Range (E)</td><td>Maximum displacement from center line</td></tr><tr><td>E < 2m</td><td>20 mm</td></tr><tr><td>2m < E < 3m</td><td>30 mm</td></tr><tr><td>E > 3m</td><td>40 mm</td></tr></table>
Schunk designs comply with the EN standard.</td><td>Section number stated not understood.

Yes. That is what is required in Section 4.11 (Section 4.6.4 in the third draft).</td><td>Closed</td></tr>
<tr><td>139</td><td>D2.1</td><td>C. Mullen</td><td>14</td><td>4.79</td><td>Static force minimum value should be increased to 93N where 60 mm wide carbon strips are utilized.</td><td>Reference should be Section 4.9. Contact force is to be adjustable. Let the pantograph manufacturer and authority jointly determine the optimum force. See Section 4.6.2 in the third draft.</td><td>Closed</td></tr>
<tr><td>140</td><td>D2.1</td><td>C. Mullen</td><td>14</td><td>4.9</td><td>Correct the table WR at greater than 80% to read +- 15N. It currently reads 2150 Newtons.</td><td>The table does read 15 N. The value of 20 N was in an older draft.</td><td>Closed</td></tr>
</table>

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
141	D2.1	C. Mullen	14	4.10	There would not be a negative effect on the pantograph from aerodynamic influence at operating speeds up to 95mph.	Agree. Furthermore this standard does not consider pantographs for vehicles operating at those speeds. See comment 108 above.	Closed
142	D2.1	C. Mullen		4.12	The 54” length for Carbon collector is really not necessary. This consumable is a very high cost. The additional length is not necessary and it adds weight. We should be reducing mass. I would suggest the 42” inch length as standard	The standard length is 52”, not 54”. This is the standard width requested by the OCS people, unless the operating authority specifies otherwise. It should remain as the standard length unless there is a need to change it. Anyway, the operating authority can specify a different length.	Closed
143	D2.1	C. Mullen	15	4.12	It is not possible to define the exact percentage of copper content that is vacuum impregnated into the voids in the carbon material. If only copper is impregnated it would account for somewhere between 15-35% depending on the individual strip. Impregnated carbon strips have a higher material current rating, higher impact strength. It is not possible to provide a one piece curved design impregnated carbon strip that is 54” inch long. It is only possible to extrude up to approx. 1300mm in length as one pc. The vacuum impregnation vessels can not handle this length. The 42” inch carbon strip can be supplied as a one piece, impregnated collector. I would eliminate the radius dimensions.	This was discussed at the meeting in Houston. If a one-piece design can not be accommodated, particularly with a curved design, then a two-piece contact strip is allowed. See Section 4.5.4 in the third draft. The radius requirement is to be the standard, unless otherwise specified by the operating authority	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
144	D2.1	C. Mullen	18	5.11	It is not possible to define the amount of damage that occurs as a result of an impact in service from some anomaly in the OCS. Note: Resetting of a shear pin safety system requires the vehicle to be shopped. Pneumatic systems utilizing pressurized carbon strips are activated with the release of the air pressure from the carbon collector. If the carbon strip is only cracked then the system can be rest on line with a bypass valve to enable the vehicle to travel to the maintenance facility.	This is a lab test requirement, not an in-service requirement. The intent here is to describe a qualification test that simulates the worst case situation for the particular pantograph and operating system at its critical speed (for example, a mechanical system, being slower to reach at higher speeds should be tested at a higher speed. On the other hand, a pneumatic ADD system might be tested at a lower speed). The committee reviewed the wording at the Houston meeting but could not come up with any different wording due to time constraints. Any assistance on different wording would be appreciated. See Sections 4.7.3 and 5.8.4 in the third draft.	To be reviewed by the committee Comment applies to Section 5.8.4
145	D2.1	C. Mullen	19 - 20	5.13 - 5.17	Al these tests are very expensive and only needed for brand new designs. In the EN 50206, pantographs with more than two (2) years in service do not require these tests. I think this should be included the IEEE standard.	An exemption is allowed if the manufacturer can provide evidence of prior testing on production units. See Section 5.	Closed
146	D2.1	C. Mullen	22	5.22	The measurement of retaining force in lock down position can not be completed on pantographs that do not include mechanical latch.	Consideration was given to require a positive mechanical latch, but that was not included although people believe that it is the best method for retention. However, regarding the comment, whatever way is used to hold the pantograph in the lock down position, some amount of force would eventually move it. In the case of a toggle mechanism, that force may not be attainable. However this is a minimum force requirement and to apply to any design. Therefore the requirement should stand.	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
147	D1	Lou Tobio	7	3.1.16	Springs should be covered with shields to protect against snow and ice that may interfere with rising of the pantograph.	Agree. This section is only the definition, not the requirement. The snow shield has already been included in the third draft, version D3, in Section 4.8.3.	Closed
148	D1	Lou Tobio	8	3.1.23	The manual emergency release is used for rising but not lowering. A pole or a foot pump is used to lower the pantograph. It cannot be done in a controlled manner.	A manual emergency release can be used for lowering and raising the pantograph. Depending on the type of actuation system used, a foot pump could be used for either or both lowering and raising, and it can be designed to be controlled. This is the definition, but has been revised. The words “in a controlled manner” have been added to the requirement, Section 4.7.2 in version D3.	Change incorporated in Section 4.7.2 of Draft D3
149	D1	Lou Tobio	8	3.1.25	The Auto Drop and the breakaway mechanism can also lower the pantograph if there is an anomaly with the pantograph. The Auto Drop will lower the pantograph if the carbon strip has worn beyond the condemning limit.	This is the definition of the operating system, not the auto drop system. Section 3.2.16 in the third draft is the most recent definition of the auto drop section. Section 4.7.3 includes the requirements of that system. Prefer to leave these sections in their most fundamental form, where an obstruction causes the auto drop system to function. Including functions such as lowering the pantograph when the contact strip has worn beyond its limit may not be available to all pantograph manufacturer and it would be best left up to the operating authority at the time. Not every pantograph supplier would have this function.	Closed pending further comment by committee If committee feels that standard should include that the ADD also detect worn carbons, please let me know. Comment applies to Section 4.7.3
150	D1	Lou Tobio	9	3.1.34	A figure is needed for this section.	Yes. Figure C.2 showing the collector head preferred dimensions, as well as the head angle, has already been included in the third draft. That figure is a blow-up of that shown in Figure A.1.	Closed
151	D1	Lou Tobio	9	3.1.39	Raised to the lowest level should be replaced with “with the pantograph locked down”.	This has already been changed per the meeting in Houston. See revised wording ion section 3.3.13 in the third draft	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
152	D1	Lou Tobio	9	3.1.39	It should be stated if the lock down height is a mechanical, pneumatic, electrical, or a combination.	This is only a definition of lock down height, not a requirement of how the pantograph is to be locked down. It can be either. No specific methodology is excluded. However it must be service proven as has been stated in Section 4.7.1 of the third draft.	Closed
153	D1	Lou Tobio	11	3.1.48	How is this measurement made? The static force must be adjustable.	This section should have been numbered 3.1.51 in the second draft. This is a definition of static force, not a requirement or a procedure for its measurement. The adjustability requirement is in Section 4.6.2 of the third draft where it is required to be adjustable between 62 and 125 N (14 to 28 lbs). The second paragraph of the section states how the measurement is to be made. Other than that, this is a standard and can not get into great detail about the equipment used for measuring parameters. See section 5.8.16 for the current wording on how the test is to be conducted.	Closed
154	D1	Lou Tobio	11	3.1.50	Definitions of static force, vertical force and aerodynamic force would be helpful.	This section should have been numbered 3.1.53 in the second draft. This is a definition of total force. Static force is defined in section 3.4.7 of the third draft. Vertical force is the same as static force as it is defined in the vertical direction. Aerodynamic force is clarified in Section 3.4.9 of D3.	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
155	D1	Lou Tobio	13	4.6	It should be stated that two end horns constitute an assembly.	Depending on the design, there can be either two or four end horns for a conventional collector head with two carbon strips. Each contact strip can have separate horns at each end, resulting in four horns. Or there can be a single horn at each end of the collector head with the horn attaching to the end of both contact strips.	Closed
156	D1	Lou Tobio	13	4.6	The end horns are also attached to the carbon rails. The end horn material, method of fastening and coating such as paint should be defined.	Prefer to leave horn material up to manufacturer. There are different methods, ranging from cast aluminum horns to a bent tubing one-piece horn that connects the end of both contact strips. Some contact strips will be bonded or soldered to a backing plate. Others will use a socket rail design.	Closed
157	D1	Lou Tobio	13	4.6	The hook must be integral to the end horn.	Agreed. The standard will be changed to suit. The option for attaching the hook with fasteners will be removed in Section 4.5.5 of the third draft.	Change incorporated in Section 4.5.5 of Draft D3
158	D1	Lou Tobio	13	4.7	English units should be added.	IEEE requires that metric units be used as the primary unit of measure in standards. English units may be used in parenthesis or footnotes. Therefore all units will be metric with the English unit following in parenthesis.	Closed
159	D1	Lou Tobio	13	4.8	Tolerances must be included with the operating requirements.	No tolerances have to be included. These are operating requirements specified by the operating authority and if they wish to include tolerances, then that is up to them. This standard can not presume what tolerances should be added to parameters unique to specific vehicles or to the authority.	Closed
160	D1	Lou Tobio	15	4.13	The second paragraph is confusing and requires clarification.	This has been rewritten per the Houston meeting. See Section 4.7.1 in third draft D3.	Closed
161	D1	Lou Tobio	15	4.14	Use of an air filter and air dryer is critical and will prevent pneumatic failures.	Agreed. A requirement for an air filter and dryer is already in the standard. Section renumbered to 4.7.1.	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
162	D1	Lou Tobio	15	4.15	The auto drop system must have the ability to adjust sensitivity. The system must also be designed to prevent nuisance drops. The design must be such that there is a minimum amount of components and valves. Lowering time when the auto drop system is activated must be minimal, that is, significantly less than the normal lowering time. Failure of the pneumatic carbon and wear beyond the carbon-condemning limit will also activate the auto drop system.	A system to detect worn carbon inserts is beyond the scope of this standard unless the committee feels otherwise. Please review Section 4.7.3 to see if it answers the comments.	Closed pending further review. Comment applies to Section 4.7.3
163	D1	Lou Tobio	16	4.1.7	Metal preparation and the paint system should be defined.	Section should be 4.17, not 4.1.7. The metal preparation and paint system is beyond the scope of a standard. However Section 4.8.3 in the third draft requires either a three-coat paint system pr a powdered coating system.	Closed
164	D1	Lou Tobio	16	4.1.8	Raised letters and numbers with a stainless steel nameplate along with the method of fastening should be specified.	Should be Section 4.18. This would preclude stick-on adhesive labels used by many equipment suppliers these days. This has been discussed in committee and it was agreed that the requirement should remain as is. However, on further reflection and based on your comment, I have changed Section 4.8.4 of the standard to require such a nameplate.	Change incorporated in Section 4.8.4 of Draft D3
165	D1	Lou Tobio	16	4.1.8	The date and year of manufacture will be of value for overhaul purposes.	Should be Section 4,18, The date and year of manufacture would be of use only the first time the unit is overhauled. Rather than relying on such data on the nameplate, the operating authority should depend on the equipment logbook and on its own records to determine when a piece of equipment should be overhauled. There are many examples in the industry where the date of manufacture can be several years prior to the equipment being placed in service.	Closed

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
166	D1	Lou Tobio	17	5.3/5.4	The pantographs and/or components must be tested to determine the failure mechanism if a problem is encountered during the warranty period.	Agreed. The phrase “or for investigation into in-service problems or failures” has been added in D3.	Change incorporated in Sections 5.3 and 5.4 in Draft D3
167	D1	Lou Tobio	18	5.8	There should be criteria for physical defects.	This level of detail could be never ending and is probably not necessary in a standard. Believe that it is sufficient to just state “free from physical defects”.	Closed pending committee comments. Comment applies to Section 5.8.1.
168	D1	Lou Tobio	19	5.9	Weight must include a completely assembled pantograph with all components.	Agree. Section 5.8.3 in the third draft has been changed to include the wording “The pantograph must be in a completely assembled and ready-to-run condition, with all components and parts included.”	Change incorporated in Section 5.8.3 of Draft D3
169	D1	Lou Tobio	18	5.10	The accuracy of the measuring equipment should be specified.	This has been clarified in Section 5.6 which refers to all test and measuring equipment. The following sentence has been added: “The test and measuring equipment shall have the accuracy necessary for determining conformance of the parameter being measured with approved drawings and other operational data with tolerances, but in no case shall it be greater than ± 3%.”	Change incorporated in Section 5.6 of Draft D3
170	D1	Lou Tobio	18	5.11	The drop time and sensitivity test are required in this section.	The requirement is that compliance with the requirements of Section 4.15 (now 4.7.3) be met. That section includes the drop time and sensitivity requirements. However the words “Special attention shall be made to the measurement of the drop time and the sensitivity of the automatic drop down system to nuisance trips.” Is this acceptable to the committee?	Change incorporated in Section 4.7.3 of Draft D3

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
171	D1	Lou Tobio	18	5.11	Damage to the pantograph may occur during this testing.	Yes, it may. But the requirement is that no damage shall occur, other than the initial damage to the collector head as a consequence of conducting the test, and those items which react to the operation of the automatic drop down system, such as shear ins or welded joints."	Closed
172	D1	Lou Tobio	19	5.12	Confirmation of the raising and lowering times as specified by the customer must be included in this section.	It is, in the second paragraph. However, the requirement has been moved to the requirements Section 4.7.1, and the raise time was changed from 10 seconds to a more typical 5 seconds. Comments anyone? The test Section 5.8.5 (formerly 5.12) has been changed to refer to Section 4.7.1. This was discussed at the meeting in Houston.	Open pending further input from committee on raising and lowering times. Comment applies to Section 4.7.1.
173	D1	Lou Tobio	19	5.13	Temperature has an effect on the raising and lowering times. Cycling of the pantograph up and down while recording the raising and lowering times specified by the customer should be included in this section.	Agree. This section has been renumbered to 5.8.6, which has been revised. The requirement "The tests shall be repeated sufficient times to assure repeatability to the customer's satisfaction, but not less than three (3) times." has been added	Change incorporated in Section 5.8.6 of Draft D3
174	D1	Lou Tobio	19	5.13	Rising time vary depending upon customer requirements. Ten (10) seconds is not typical.	If 10 seconds is not typical, then does anyone have any suggestions as to what is typical for operating at the extreme temperatures?	Open pending further input from committee on raising and lowering times. Comment applies to Section 5.8.3
175	D1	Lou Tobio	19	5.14	Successive raising and lowering using 10,000 cycles may not be stringent enough for some applications. The Blue Line application is more demanding since the pantograph is raised and lowered for each trip in revenue service.	The 10,000 cycle requirement is from both the British and international standards. Would prefer to leave this as is as it seems sufficient. What do committee members think? If a vehicle makes 15 round trips each day with one pantograph raising and lowering cycle each trip, that would result in 10,000 cycles of about 2 years of operation.	Open pending further input from committee on endurance test cycles. Comment applies to Section 5.8.7

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
176	D1	Lou Tobio	19	5.14	Consideration should be given to conducting mechanical endurance tests between –13 and 104 degrees F since problems occur at these temperatures more often than at ambient temperature.	Section renumbered to 5.8.7. OK. How about this wording being added: “During the second 500 raising and lowering operations (501st to 1,000th cycle), the pantograph shall be raised to the Maximum Extended Height (HME) with the temperature set at the minimum value of the test of Section 5.8.6 and with the operating system air supply pressure or voltage at the minimum values for which the supplier guarantees operation. During the next to last 500 raising and lowering operations (9,000th to 9,500th cycle) raising and lowering operations, the pantograph shall be raised to the Maximum Extended Height (HME) with the temperature set at the maximum value of the test of Section 5.8.6 and with the operating system air supply pressure or voltage at the minimum values for which the supplier guarantees operation.” to the standard? The values of be -40°C and +70°C (-40°F and +158°F) are from the environmental standards of IEEE 1478.	Open pending further input from committee on endurance tests at temperature extremes. Comment applies to Section 5.8.7
177	D1	Lou Tobio	19	5.14	The customer shall define abnormal wear and no anomalies.	Agree. Definition has been added. See Section 3.1.1 in third draft for definition.	Change incorporated in Section 3.1.1 of Draft D3
178	D1	Lou Tobio	19	5.14	The methods for inspecting for distortions or fractures have to be defined. The question arises in regard to inspection for these defects.	Methods for conducting inspections are outside the scope of this standard.	Closed
179	D1	Lou Tobio	22	5.22	The accuracy of the measuring instrument has to be defined.	See comment 169 above regarding test equipment accuracy.	Change incorporated in Section 5.6 of Draft D3

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Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
180	D1	Lou Tobio	22	5.23	The raising and lowering speed is also a function of customer requirements.	Section renumbered to 5.8.16. The 0.05 m/sec raising and lowering speed is not a pantograph performance requirement; that is included in Section 4.7.1 as 5 seconds. It is the raising and lowering speed at which the static force is to be measured. However, another issue will change this requirement. Although the 0.05 m/sec is a British and European standard, the speed at which the force is measured really should be at the speed at which the pantograph rises and falls when negotiating gradients in the overhead contact wire. Section 3.4.12 defines the maximum permissible pantograph frame vertical speed and Section 4.6.7 specifies it as 0.15 m/s in lieu of an authority specification. This means that the static force test should be conducted at this raising and lowering speed, which is three times that stated. Therefore Section 5.8.16 (formerly 5.23) will be changed from 0.05 m/s to 0.15 m/s.	Change incorporated in Section 5.8.16 of Draft D3
181	D1	Lou Tobio	22	5.24	The requirements have to be in accordance with customer speed and wind requirements. The accuracy of measuring equipment is needed in this section.	Section renumbered to 5.8.17. IEEE Standard 1478 is referenced for environmental standards. See Section 4.8.3 in the third draft. Speed requirements are to be defined by the operating authority. See comment 171 above regarding test equipment accuracy.	Closed

Comments on Draft Standard IEEE-P1629D2.1 Performance Standard for Pantograph Current Collectors for Rail Transit Vehicles							
Comment Number	Standard Version No.	Comment From	Page Number	Section Number	Comment	Response	Status
182	D1	Lou Tobio	22-23	5.25/5.26/ 5.28	Deformation or abnormal heating and no damage require defining criteria.	Believe that the terms as stated will suffice. Deformation and abnormal heating should be descriptive as is.	Closed pending further review by the committee. Comment applies to Sections 5.8.18, 5.8.19 and 5.8.21
183	D1	Lou Tobio	25	Annex A	An illustrated parts list is required to supplement the drawing.	Agree. That has already been added to Annex A in the third draft.	Closed
184	D1	Lou Tobio	N/A	Additional Comments	Temperature has an effect on pantograph operation. An ambient temperature range consistent with the operational environment is a consideration.	That is specified by reference to IEEE Standard 1478. See Section 4.8.3 in the third draft.	Closed
185	D1	Lou Tobio	N/A	Additional Comments	Pneumatic hoses impervious to UV and weather should be included in this standard.	Agree. Pneumatic hoses have not specifically included, but an insulator was. Pneumatic hoses have now been included.	Change incorporated in Section 4.7.1 of Draft D3
186	D1	Lou Tobio	N/A	Additional Comments	Thought should be given to bearings, that is, sealed or with grease fittings.	Yes. A requirement for bearings has already been added in the third draft.	Closed
187	D1	Lou Tobio	N/A	Additional Comments	The overhaul and possibly repair time, operation/maintenance manuals and warranty would be nice to include in the standard.	These requirements are presently beyond the scope of an IEEE standard. Reference has been made on Section 4.9 to general maintainability requirements and to the APTA pantograph maintenance standard with the requirement that the design and manufacture of the pantograph be in compliance with the requirements of that standard. Requirements for operation and maintenance manuals are best left to the operating authority. See Section 4.9.3	Closed pending further review by committee. Comment applies to Section 4.9

Open Items from Document P1629D2.1 Comments.doc Not Changed in the Third Draft D3		
Comment	**Section in P1629D3**	**Issue**
8	3.1.10, 3.1.12	Should the following APTA definitions of Light Rail and Heavy Rail be used in lieu of what is there? APTA definitions below: **Rail, Heavy** An electric railway with the capacity for a "heavy volume" of traffic and characterized by **exclusive rights-of-way**, multi-car trains, high speed and rapid acceleration, sophisticated signaling and high platform loading. Also known as "rapid rail," "subway," "elevated (railway)" or "metropolitan railway (metro)." **Rail, Light** An electric railway with a "light volume" traffic capacity compared to heavy rail. Light rail may use shared or exclusive rights-of-way, high or low platform loading and multi-car trains or single cars. Also known as "streetcar," "trolley car" and "tramway." The author prefers what is already in the standard.
13	3.2.6	Should the words “in a vertical or nearly vertical direction with respect” be replaced with “perpendicular”?
107	Annex A	Is Figure A.1 in Annex A sufficiently generic, or should it be revised? Can someone re-draw the figure?
111	3.2.6	Is the description of a pantograph too oriented to a particular design, or is it sufficiently generic? Does alternate terminology need to be included? Then what wording?
112	3.2.7	Is the definition of the primary suspension acceptable? Should it even be included? Is it too oriented toward a particular vendor?
136	3.4.7	Should primary suspension be eliminated? Is the definition of primary suspension in Section 3.2.7 acceptable?
137	3.4.8	Is the definition where the number of positions for determining the nominal static force acceptable, or should this be over the working range. This is a definition of how the force is determined, not a requirement of where the force is effective.
144	5..8.4	Are the requirement of “Other than the initial damage caused by the failure of the collector head, any parts that intentionally fail as a consequence of the operation of the automatic drop down system, such as shear pins or breakaway components, shall be replaceable without a complete disassembly or rebuilding of the pantograph.” in Section 4.7.3 and “no additional damage shall occur to the pantograph beyond those items which react to the operation of the automatic drop down system, such as shear ins or welded joints” in Section 5,8,4 practical and should they be changed? What wording should be used?
149	3.1.25 and 4.7.3	Should the Auto Drop System incorporate detection of worn carbon condition?

Open Items from Document P1629D2.1 Comments.doc Not Changed in the Third Draft D3		
Comment	**Section in P1629D3**	**Issue**
162	4.7.3	Are the requirements sufficient?
167	5.8.1	Is a definition for physical defects needed?
172	4.7.1	Are the 5 second raising and lowering times acceptable?
174	5.8.6	If the 10 second rise and lower time under extreme temperatures is not typical, then what is?
175	5.8.7	Should the 10,000 cycle mechanical endurance requirement be increased?
176	5.8.7	Are the current temperature extremes for the endurance tests of The values of be -40°C and +70°C (-40°F and +158°F) too extreme? Should they be revised to -25°C and +40°C (-13°F and +104°F)
182	5.8.18, 5.8.19 and 5.8.21	Is it necessary to define deformation or abnormal heating and no damage and include criteria?
187	4.9	Should more specific requirements for maintenance and parts documentation, and warranties, be included.